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HOME CANNING[1]

W. V. CRUESS[2] AND A. W. CHRISTIE[3]
Revised by W. V. CRUESS

CONTENTS

INTRODUCTION

REQUESTS FOR INFORMATION on the home canning of fruits and vegetables are received at this Station with increasing frequency. This circular is intended to describe approved methods and also to give general information asked for by numerous inquirers.

A large quantity of fruits and vegetables goes to waste every year or is sold at prices which return little profit. Much of this, while unsuited to the special requirements of the commercial cannery, is well adapted to canning for home use. The quality may be as good as that of the products of commercial canneries if put up with the proper knowledge and care. It is often possible to find a limited market for home products of this kind at profitable prices.

Local and private markets are usually the most satisfactory for the home or farm canner. He will seldom find it profitable to sell on the general market through dealers in competition with commercial canneries.

[1] The writers desire to express their appreciation to Professor F. T. Bioletti, Dr. K. F. Meyer, Dr. J. C. Geiger, Dr. S. H. Ayers, Dr. J. R. Esty, Dr. C. A. Magoon, Mr. A. Richardson, and others for valuable suggestions given during the preparation and revision of the original manuscript for this circular; and Miss Hilda Faust for additions to and revisions of the present edition.

[2] Professor of Fruit Technology and Chemist in the Experiment Station.

[3] Assistant Professor of Fruit Products and Associate Chemist in the Experiment Station; resigned June 30, 1928.

PRINCIPLES OF CANNING

CAUSES OF SPOILING

The principal aim of canning is to prevent spoiling. Spoiling is not due directly to the action of air or of heat and it is not simply a chemical or a physical change. When vegetable materials ferment, decay, or turn sour, the spoilage is due to the growth of certain microscopic living organisms, or germs. These all belong to the vegetable kingdom and are divided into three groups: molds, yeasts, and bacteria. Familiar examples of each group are the blue-green mold of spoiled fruits, the yeast used in bread making, and the bacteria of the scum, or mother, of vinegar. What we see in compressed yeast, for instance, is simply a mass consisting of millions of germs. Individual germs are too minute to be seen without a microscope. Their activities cause the molding of jellies, the swelling and souring of canned fruits, the spoiling of canned vegetables, and the putrefying of meats. The character of the material largely determines which type of spoiling will occur. Acidity is favorable to yeasts and molds. Fruits may therefore spoil by yeast fermentation or become moldy. Most bacteria prefer a medium with little or no acid. Decay of vegetables or meats is therefore usually due to the action of bacteria. Neither fruits nor acid vegetables are favorable to the growth of most bacteria.

Yeasts, molds, and bacteria are widely distributed and occur in the air, in water, on fruits and vegetables, and in great abundance in soil and dust. Hence at the time of canning not only the fruit or vegetable but also the sirup or brine and the containers are more or less heavily contaminated with all manner of microörganisms.

METHODS OF PRESERVING

The microörganisms which cause spoiling come from the air or from the surfaces with which the material comes in contact. They can no more develop from nonliving matter than wheat can appear spontaneously in soil devoid of wheat seed. In food preservation, we are dealing with living organisms, whose activities can be prevented in one of two ways: we may kill all the germs present by heat or other means and prevent the entrance of all others, or we may make the conditions so unfavorable to the germs that they cannot grow or do any damage. The latter way is followed when we impregnate meat with so much salt that bacteria cannot grow, or add so much sugar to jam that yeast cannot multiply. The heat method is utilized in most methods of canning.

Sterilization by Heat.—The killing of all germs present is called sterilization. In canning, this is accomplished by heating. The material to be preserved is placed in a jar or can, in which it is sealed hermetically, that is, the container is made airtight. It is then heated to a temperature fatal to all the germs it contains. No spoiling can then take place until the vessel is opened, since there are no means by which germs can enter.

Molds and yeasts that occur on fruits and vegetables are quickly killed at temperatures below 212° Fahrenheit, the boiling point of water at sea level. On the other hand, bacteria that cause spoiling of vegetables are much harder to kill, many of them withstanding the temperature of boiling water for several hours. These bacteria owe their astonishing resistance to the presence of spores.

These bacteria with resistant spores probably occur on fruits, but it is usually not necessary to kill them in this case, for they are very sensitive to acidity and therefore usually cannot grow in fruit juices. Fruits low in acid, such as figs and overripe pears, apricots, and peaches, are an exception to this statement. Bacteria will grow in canned fruits when the acidity is low. With vegetables the case is different. These, with the exception of tomatoes and rhubarb, have little acidity and are well suited to the growth of the heat-resistant bacteria. To sterilize vegetables it is therefore usual to heat the sealed cans to temperatures above 212° F. The temperature can be raised to boiling, which is approximately 212° at sea level, by placing the sealed cans in an open tank or pot containing boiling water. But under these conditions no higher temperatures can be reached, because the evolving steam removes the excess of heat as fast as it is applied. At high elevations water boils at temperatures below 212.° In a closed space where the steam cannot escape, however, higher temperatures can be obtained. As the temperature rises the pressure increases. In canning vegetables, pressures of 5 to 15 pounds to the square inch are generally used. This corresponds to temperatures of approximately 227° to 249°; the higher the pressure the higher the temperature.

Acidified Brine.—Experiments in the Fruit Products Laboratory of the College of Agriculture and in other laboratories have demonstrated that nonacid vegetables can be safely sterilized at 212° F in acidified brines. This method is used at present commercially for artichokes. However, owing to the difficulty of measuring accurately the brine and the acidifying ingredient (vinegar, fruit acid, or lemon juice) in the home, the method is not recommended at present for home use.[4]

[4] First described in: Cruess, W. V. Home and farm canning. California Agr. Exp. Sta. Cir. 158:1–31. 1916. (Out of print.)

Sterilizing Nonacid Vegetables.—In home canning, as explained later in this circular, nonacid vegetables are preserved by several different methods of sterilization. However, as far as the western states are concerned only one of these methods, sterilization in steam under pressure, that is, in a pressure cooker, is recommended. *For the nonacid vegetables, such as asparagus, peas, corn, string beans, spinach, and the root vegetables, the various methods of sterilizing at the boiling point of water or in an oven are unsafe, and should not be used in the region specified.*

Drying and Pickling Nonacid Vegetables.—In the home it is often more convenient and safer to preserve vegetables by pickling in brine or by drying than by home canning. Drying is recommended in preference to canning of certain nonacid vegetables, particularly string beans, peas, corn, and spinach. Directions for these other methods will be sent on application to the Agricultural Extension Service, College of Agriculture, Berkeley.

Sterilizing Fruit Juices.—Heating fruit juices to 212° F always changes the flavor more or less. In a few cases, this change of flavor may be an improvement, but in most cases it is desirable to retain as much of the original character of the juice as possible. This is accomplished by careful handling and by heating to the lowest temperature that will insure sterilization. Experiments have shown that most juices can be safely sterilized at temperatures of from 175° to 185°. (See Extension Circular 65.[5])

Preservatives.—Food materials can be prevented from spoiling by the use of certain substances known as preservatives. Some of these are injurious to health and forbidden by the pure-food laws. Others are not encouraged by the pure-food laws, because they have been used by unscrupulous manufacturers to disguise defective materials or careless methods of manufacture. The use in canning of such preservatives as benzoate of soda, salicylic acid, sodium fluoride, boric acid, etc., is not recommended.

Certain preservatives, however, are useful and permissible. For fruits, sugar is the preservative most commonly used. If the sugar content of fruit juice, jelly, or jam is raised to 70 per cent by evaporating part of the water, or by adding sugar, these products become unsuitable for the growth of microörganisms and will keep even in open vessels. This is why dried fruit does not spoil and why jam must be made very sweet.

For some products salt is extensively used, as in preserving olives in barrels and in keeping certain types of pickles. Vinegar and spices are

[5] Cruess, W. V. Preparation of fruit juices in the home. California Agr. Ext. Cir. 65:1–15. 1933.

used in the same way. Sometimes a combination of the effects of heat sterilization and harmless preservatives such as vinegar is used in the preserving of pickles, etc.

HOT- AND COLD-PACK METHODS

The principles and theory of canning are the same whatever the scale on which it is done. The differences are only in the mechanical details of the methods.

There are two general methods of home canning in use. In one, known as the "hot-pack method," the material is cooked in open pots and poured into the cans while hot, together with the hot brine or sirup. The cans are sealed immediately, and should be sterilized by further heating. In the other, the "cold-pack method," the freshly prepared material is placed cold in the cans and then covered with the hot sirup or brine, sealed, and sterilized. With both methods the material is always hot when the cans or glass jars are sealed. The cold-pack method is generally the best for vegetables, while the hot-pack method can often be used to advantage with fruits, if supplemented by sterilization in the container. This last method is advised for use in the present war-time emergency as it requires fewer jars or cans; the product is packed without added liquid.

EQUIPMENT

GENERAL EQUIPMENT

Most of the utensils and materials needed in home canning are to be found in all kitchens. They include a good stove; a table for the preparation of materials; a sink; a good supply of water; various agateware or aluminum pots, saucepans, and buckets; large cooking spoons; and a sufficient supply of sugar and salt. To these should be added a good thermometer, reading to at least 250° F and suitable for placing in liquids (cost, about $1.50). A Balling or Brix saccharometer, or sugar tester, is also very useful where fruit is to be canned on a farm scale. It should read from 0 to 70 per cent and costs about 75 cents. For use with this will be needed a tin cylinder to hold the liquids to be tested. It should be about 1½ inches in diameter and about 12 inches long (fig. 11). The thermometer and saccharometer can often be obtained through a drug-store or local dealer.

Simple tools generally useful are shown in figure 1. These are a knife (*A*) fitted with a guard to prevent excessive waste of pulp in peeling, and a broad knife (*B*) for cutting and slicing. For clingstone peaches a special spoon (*C*) with sharp edges is used. A curved knife (*D*) is used

for removing the cores of halved pears. A coring knife (*E*) is used for coring apples. A cherry pitter (fig. 13) is very useful. Slicing and cubing machines are available for vegetables.

Fig. 1.—Knives used in canning: *A*, peeling knife; *B*, cutting knife; *C*, peach-pitting spoon; *D*, pear-coring knife; *E*, apple-coring knife.

STERILIZERS

A sterilizer is a vessel in which the filled cans or jars are heated to the degree and for the time necessary to sterilize their contents.

Sterilizers for Use at Boiling Point.—An ordinary wash boiler fitting the top of the kitchen stove can be made to serve as a very satisfactory sterilizer for use at the boiling point of water. A piece of heavy wire screen of half-inch mesh or a wooden rack cut to fit should be placed in

the bottom of the boiler to prevent breaking of the jars. Inexpensive and very satisfactory jar racks are now obtainable at most hardware stores. Such a rack is shown in figure 15.

Use of Baking Oven.—Many home canners and some equipment dealers have the mistaken belief that jars of food heated in a baking oven attain the temperature of the oven. This is a very serious and dangerous error. They reach only the temperature of boiling water, at sea level namely 212° F, because as soon as the boiling point is reached the contents of the jars boil, steam escapes from beneath the lid, and consequently the temperature cannot exceed that of boiling water. Home canners are warned against this dangerous fallacy. See the next paragraph.

Pressure Sterilizers.—A steam pressure sterilizer is necessary for most vegetables. This form of sterilizer permits the obtaining of temperatures above the boiling point of water because the steam is confined and heated under pressure. The sterilizer consists of a metal cylinder and a heavy cap that fits the cylinder. The cap is easily removed or fastened in place by releasing or tightening thumb screws (fig. 2).

The pressure cooker is fitted with a thermometer or a pressure gauge, a release cock, and safety valve. The thermometer is much more reliable than the pressure gauge. In buying a pressure cooker, specify that it be equipped with a dependable thermometer. Pressure gauges often get out of order and become unreliable. Directions for its use accompany the sterilizer.

JARS

Glass jars are excellent for home canning of fruits because they can be used repeatedly. Their relatively high initial cost is offset by this advantage.

Glass jars are to be found in a variety of sizes and shapes and with various methods of hermetic sealing. The sizes most used are pints and quarts and to a smaller extent half-gallons. The only important variation in shape is the width of the mouth which may be as wide as the jar or only about half its width. The commonest method of sealing is by means of a rubber ring which fits between the cover and the top of the jar (fig. 3).

In the Mason jar and its various modifications the cover is a screw cap which makes a hermetic (airtight) joint when screwed down on the rubber ring. In the ordinary form this cap is of zinc with a porcelain lining. This is the commonest form. Aluminum and heavily lacquered metal caps are to be preferred to zinc caps because of the tendency of the zinc to corrode with sour fruits and tomatoes. Wide-mouthed Mason jars are

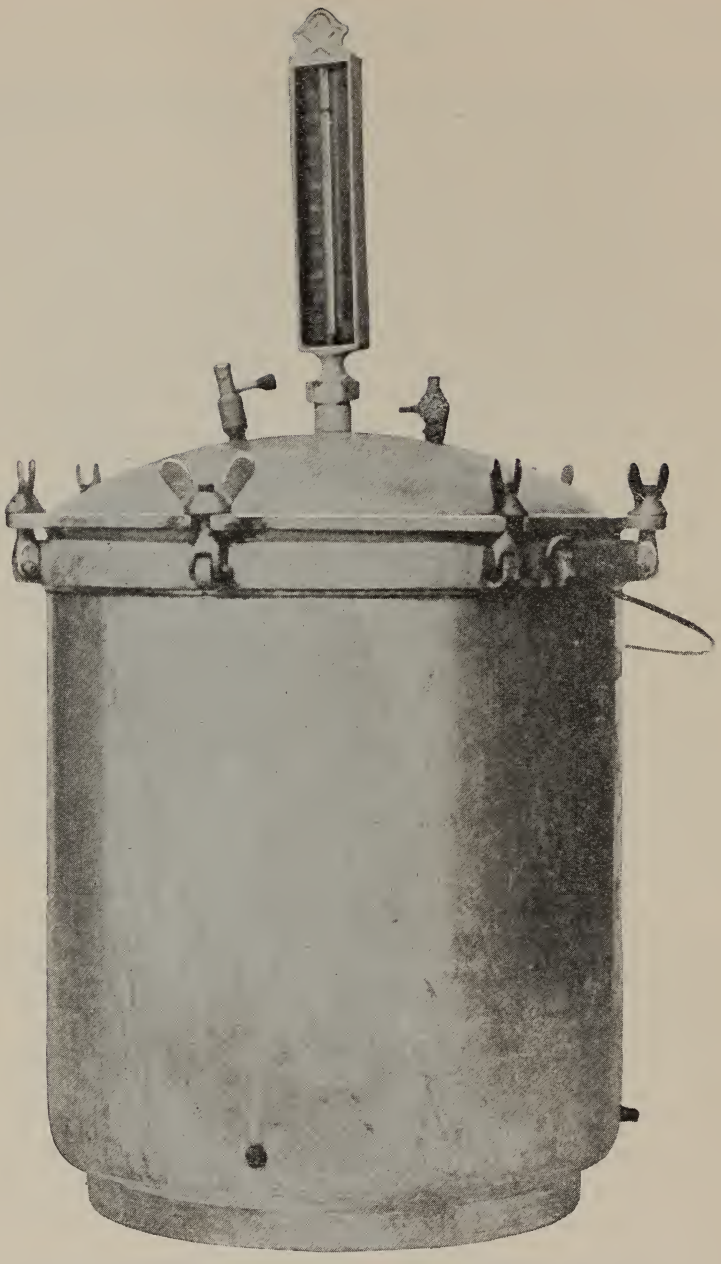

Fig. 2.—Pressure sterilizer for home use, with safety valve at left, thermometer in center, and release cock at right.

now made which are very convenient for large fruits. However, the large enameled metal screw caps (fig. 3, *D*) are often difficult to remove and may be broken in opening the jar.

In another common form, of which the Atlas "E–Z" seal jar is an

example, the cover is a glass disk held in place and pressed down on the rubber by means of a strong wire clamp. After the fruit cools the clamp may be removed and the cover will be held in place by the vacuum. This affords a means of detecting spoiled jars. If there is any fermentation of the fruit, the gas formed will fill the vacuum and the cap will be loosened. This is a very convenient and durable form of cover, and no metal parts are in contact with the fruit.

Special vacuum-sealed glass jars are used in jelly and preserve factories. They have enameled metal caps resting on heavy, soft rubber or rubber-compound rings that are held in place by a vacuum inside the

A *B* *C* *D* *E* *F*

Fig. 3.—Types of jars used in home canning: *A*, glass-top jar; *B*, Mason jar with lacquered metal top; *C*, Economy jar; *D*, Golden State wide-mouth Mason jar; *E*, vacuum seal, glass-top jar; *F*, Mason jar with zinc top.

jars. For home use some forms of these jars may be sealed by forcing the caps on by hand, while the contents are hot. On cooling, a vacuum is produced which holds the caps firmly in place.

Recently a very satisfactory new form of glass top, automatically sealing vacuum-seal jar for home use has appeared. It requires no special equipment. It is made in several sizes of jars and should prove particularly useful for home canning of fruits, preserves, and jellies.

In all cases where poor rubbers are used in sealing they must be specially treated, for they will otherwise give a disagreeable taste to the food. Fruit and vegetables are sometimes completely spoiled by this taste. It can be avoided by thoroughly boiling the rubbers in water made alkaline with two or three teaspoons of washing soda to the quart. They are then rinsed and boiled a second time in water made slightly acid with lemon juice or vinegar. A third short boiling in plain water fits them for use. There are now several good brands of jar rubbers which do not require this treatment. They can be placed directly on the jars from the package and should be used if obtainable. Owing to the war emer-

gency, rubbers may soon be unobtainable. Therefore save used rubbers for re-use later.

In some forms of jars, the rubber ring is replaced by a disk of treated or varnished pasteboard. This is not commonly used and is less generally suitable because it usually does not give an airtight seal.

A commoner type that avoids the use of rubbers is the Economy jar and its modifications. The cover is a lacquered metal disk around the edge of which runs a small groove filled with a waxlike compound. When the jar and its contents are cooling the vacuum formed seals the lid to the jar. A metal spring holds the cover in place on the Economy jar and is removed after cooling. This is jar *C* in figure 3. Lids should be new and fresh. Used lids cannot be employed a second time, because of the difficulty of securing an airtight seal. On the Kerr "self-sealing" jar the lid is held in place by a screw band, which should be screwed firmly in place before putting jars in the sterilizer.

Glass jars are suitable for use in a pressure sterilizer, although frequently much of the liquid (brine or sirup) boils out of the container, causing the jar after sterilization to be only three quarters or one half filled with liquid, unless considerable care is used during sterilizing and cooling. As more fully described in the section on use of the pressure sterilizer (page 23), if the jars and contents are heated to the boiling point and sealed tightly before the pressure sterilizer is closed, little to no liquid is lost from the jars. The cooker should be cooled slowly after the sterilization has been completed; this will greatly lessen the tendency for liquid to boil out of the jars during cooling.

These difficulties are overcome in commercial canneries by the use of compressed air in the pressure cookers, but this is not feasible in the home. In sterilizing jars under pressure the cooker should be operated as directed in the section, "Sterilizing Under Pressure."

CANS

There are three general types of cans used for fruit and vegetables—the wax-top, the solder-top, and the Sanitary.[6] While it is realized that cans may not be obtainable during the war, this section is retained for use when cans are again available.

The cover of the wax-top can is sealed on by means of a ring of hot sealing wax. It is suitable for use with fruits and tomatoes, but it is not satisfactory for vegetables which require high temperatures. The cans are easily manipulated and require no special equipment.

Solder-top or stud-hole cans with the necessary soldering tools are

[6] "Sanitary" is a trade name and when applied to this type of can does not imply that other cans are unsanitary.

used in some factory-made home-canning outfits and can be used with any outfit if proper sealing tools are available. The top of the can has a circular opening varying in width with the size and type of cans. After filling the can, this opening is closed by soldering on a tin disk. This disk is usually perforated with a small hole to allow steam to escape during the preliminary heating. This hole must be closed with solder before the final sterilization (fig. 4, *G*). This style of can, except for very few products, is now seldom used commercially and is difficult to obtain. For these reasons it is not recommended for home use.

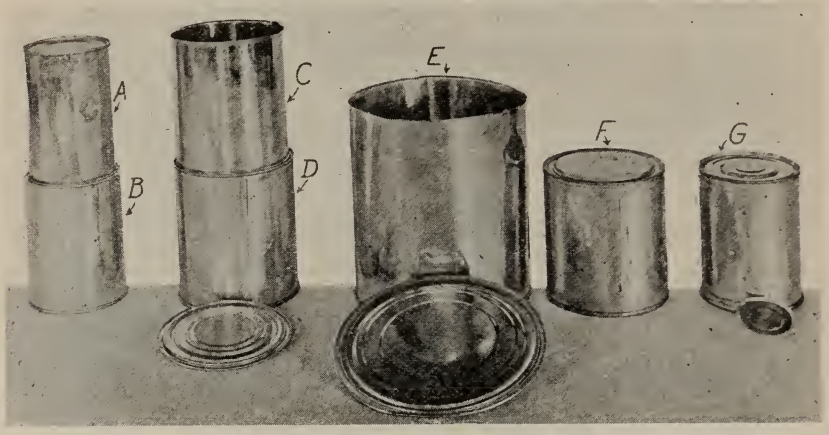

Fig. 4.—Types of cans used in home canning: *A*, no. 1 tall Sanitary can; *B*, no. 2 Sanitary can; *C*, no. 2½ Sanitary can; *D*, no. 3 Sanitary can; *E*, no. 10 Sanitary can; *F*, quarter-sized wax-top can; *G*, no. 2 solder-top can.

Sanitary cans are not sealed with solder. The cover or cap is "crimped" on by means of a special machine. A rubber coating or paper gasket on the cap where it comes in contact with the can makes the sealing doubly sure. Very satisfactory hand-power machines for home use can be obtained at moderate cost (fig. 5).

Sanitary cans are very satisfactory containers for vegetables to be sterilized under pressure in the home. Where the quantity of vegetables is too small to warrant purchase of a can sealer, it is possible for several families to join in the purchase and use of such a machine. The cost is approximately $20.

Cans may be obtained which are coated inside with a protective enamel. These are suitable for red fruits, berries, and beets because they minimize bleaching of the red color through action of the tin.

Sealing Sanitary Cans.—Sanitary cans are more satisfactory for home use than solder-top cans.

In using Sanitary cans in home canning the prepared food is packed

into the washed can and boiling hot sirup or brine is added to fill it. In commercial canning the can and contents are heated in live steam or hot water for 4 to 10 minutes before sealing in order to expel air from the food and liquid. While such preliminary heating is desirable it is not

Fig. 5.—Small hand-power sealing machine for Sanitary cans.

essential in home canning, provided the can is filled with *boiling hot* sirup or brine and sealed *at once.*

The general appearance and method of using a hand-power Sanitary can sealer are shown in figure 5. To use the sealer proceed as follows:

1. Clamp the sealer to a stout table top. Place the lid on the can and set the can on the turntable. Raise the turntable by swinging the elevating lever from the operator until it will go no farther.

2. Turn the crank rapidly and at the same time push the seaming roll lever very slowly *away from the operator* to bring the roll number one against the top of the can until it will go no farther. Fifteen turns of the crank should be sufficient.

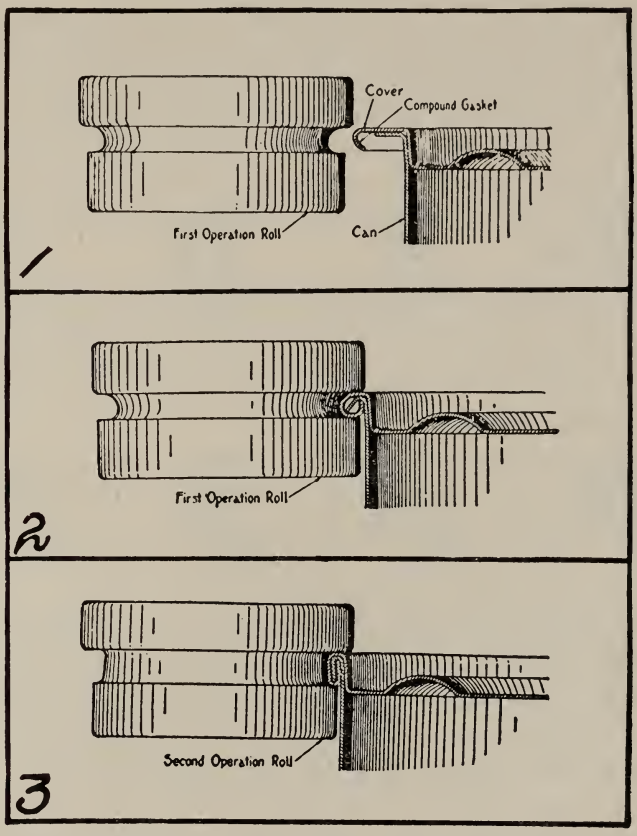

Fig. 6.—Sealing a Sanitary can. (After Cruess and Christie.) 1, Lid in place before sealing; 2, Appearance of lid and edge of can after first operation; 3, Appearance after second operation.

3. Continue turning the crank rapidly and pull the seaming roll lever slowly *toward the operator* until it will go no farther. Give the crank several more turns and remove the sealed can. Do not turn too long or the seam will be broken.

Figure 6 illustrates the top of the can before sealing, after the first seaming operation, and after the final operation. Sealing a Sanitary can is spoken of as "double seaming."

Automatic Sealers.—An improved home-sized can sealer which forms the seams automatically has appeared on the market.

Comments on Seaming.[7]—The double seam, that is, the can closure, consists of five thicknesses of tin plate, interlocked, or folded and pressed firmly together.

When the rolls on the can sealer are correctly adjusted the hook of the can lid is curled under the hook of the can by the first seaming operation. The second seaming operation forces the several thicknesses of plate tightly together and draws the gasket of the lid tightly against the top of the can. The action of the rolls in double seaming (forming the can seal) is shown in figure 6. Figure 7 shows schematically correct and incorrect methods of forming the double seam. Incorrect seaming may be due to too heavy or too light pressure on the seaming rolls; or to incorrect setting of the rolls.

Correct pressure in using hand-power sealers is a matter of practice obtained under the supervision of an experienced person. In order to determine whether your double seaming (forming the can seal) is satisfactory, compare it with that on the other end of the can, that is, the manufacturer's double seam.

The can-sealer rollers are correctly adjusted by the manufacturer; it is well to observe the setting of the rolls on the new machine as purchased. With use the rollers and their shafts wear so that the rollers no longer come sufficiently close to the chuck (the circular revolving disk on top of the sealer). The seam is then apt to be too loose or otherwise defective and slight adjustment becomes necessary. The first-operation roller should clear the chuck by about the thickness of a new dime; the second-operation roller should come very slightly closer than this to the chuck. If a commercial cannery is nearby, it may be possible to have the cannery's mechanic adjust the rollers for you occasionally.

With prolonged use the rollers become so badly worn that they must be replaced. In such a case new rollers may be secured at moderate cost from the manufacturer or dealer.

The rollers must be kept well oiled; any good grade of machine oil or medium-heavy cylinder oil will do.

Fruit juices and brine are very corrosive on the moving parts of the sealer; therefore, when sealing is completed for the day, wash the machine with hot water and dry it in the sun or above the stove, so that it will not rust or corrode.

Choice of Lid.—Can lids are sealed to the can either with a rubber composition which lies in the outer groove of the lid, or with a rather spongy paper gasket (paper washer) lying in the lid's outer groove. The use of paper gaskets has, however, been practically discontinued.

[7] Much of the information presented on testing can seams has been taken from a booklet, "The Double Seam," issued by the American Can Co., Maywood, Illinois, to whom thanks are due.

The rubber composition gasket requires very careful and accurate setting of the rollers and considerable skill and experience in operating the sealer.

Testing the Seam.—Unless the seaming is correctly done the can will leak; air with yeasts and bacteria will enter, and the canned product will soon spoil. The condition of the double seam (can seal) can be judged by filing a notch through the seam of an empty sealed can and separating the lid hook from the double seam as shown in figure 8. Directions for filing are given below the figure.

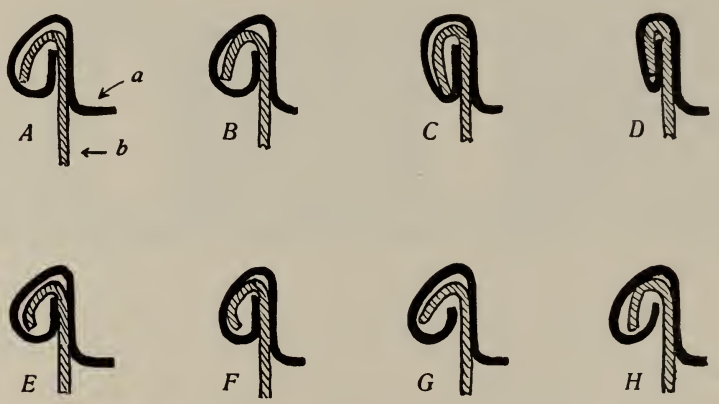

Fig. 7.—Correct and incorrect methods of forming the double seam (can closure). *A*, Correct first operation for paper gasket—*a*, top of can, *b*, body of can; *B*, correct first operation for compound (rubber) gasket; *C*, correct second operation for paper gasket; *D*, correct second operation for compound gasket; *E*, incorrect first operation for paper gasket, bottom seam too much flattened, and cover hook curled under too tightly from too much pressure; *F*, similarly for compound gasket; *G* and *H*, first operation too loose, too little pressure. (Courtesy of the American Can Co.)

Next clean all gasket material from beneath the can hook. Then insert the narrow end of the can-testing ruler into the can hook as shown in figure 9. A small pocket lens is useful in reading the ruler. If a can ruler is not available, cut a narrow strip of tin plate and scratch a mark on it $\frac{1}{16}$ inch from the end; use it as directed above for ruler.

The countersink is the distance between the top of the seam and top of the can as shown at the left in figure 10; it should measure $\frac{1}{8}$ inch. The depth of can hook and of countersink are the only two measurements made. Slight variation is permissible in these specifications; but appreciable variation indicates incorrect seaming.

The double seam as exposed in the notch filed as shown in figure 8 will tell much concerning the correctness of seaming. The folds must not

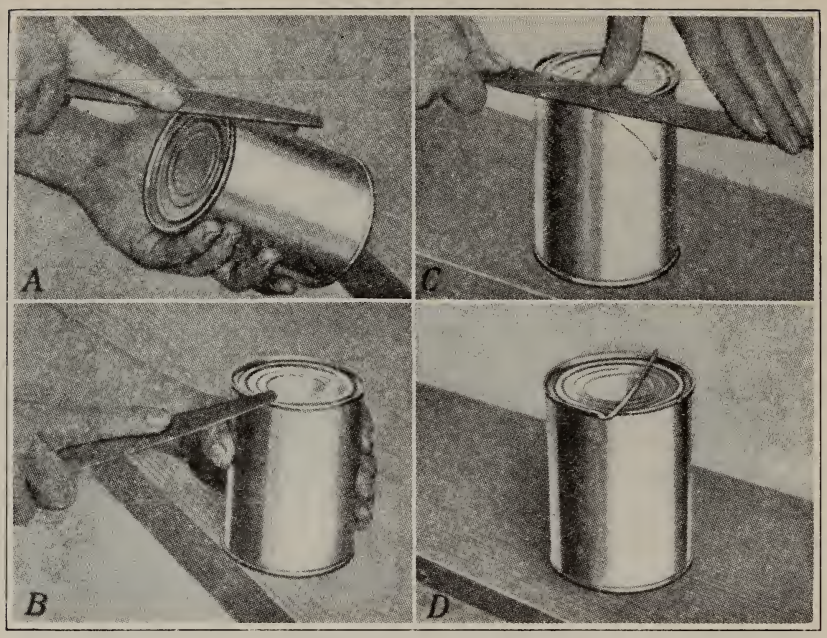

Fig. 8.—Filing a can's double seam to determine whether seaming has been done correctly or not. *A*, File a notch through at the body seam to the body of the can; *B*, starting at notch file barely through the first thickness of plate for a distance of about 1 to 2 inches; *C*, use file to force down the cover hook, the narrow thickness of plate as shown; *D*, bend the cover hook up, as shown, for observation and measuring of the can hook. (Courtesy of the American Can Co.)

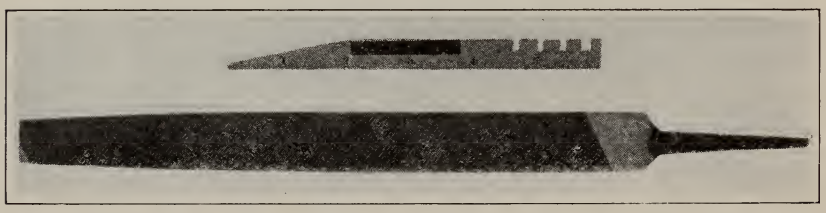

Fig. 9.—Flat file used in filing cans and thin metal ruler used in measuring can body hook, can lid hook, and width of seams. The notches in ruler are for measuring width of the double seam.

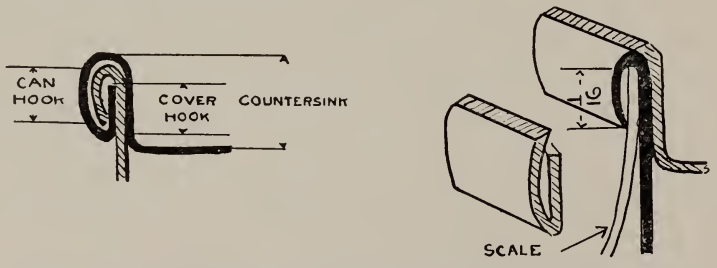

Fig. 10.—Left, diagram of double seam showing can hook, cover hook, and countersink. Right, showing method of testing depth of can hook; this should be 1/16 inch. (Courtesy of the American Can Co.)

appear pinched, for that indicates excessive pressure, which may cause cracking of the plate and leaking of the seam. If the pressure has been too low the seam will appear too open. It is again suggested for emphasis that the can maker's end of the can also be filed and examined for comparison with the seam made by yourself. It is also good practice to make occasional comparisons with seams on cans of commercially packed foods. By such means your double-seaming operations can be judged.

In case of doubt, however, several of your cans, after sealing, should be sent or taken to the nearest manufacturer of cans or to your County Home Demonstration Agent for inspection of the double seams and advice for correction of any defects in sealing. During the present emergency it is likely that it will be difficult to purchase cans for home use.

Locating the Leaks in Seams.—Frequently leaks in the double seam can be located by dropping the can after sealing, sterilizing, and cooling into a pot of hot water. Bubbles of gas forced out of the can by the heat will appear at the leaky point. However, this test is not infallible because occasionally the leak is plugged temporarily with a particle of food. "Pumping the can" is another means of detecting faulty sealing. As far as small-scale canning is concerned the following procedure may be employed. Seal an empty can. Punch a small hole in the center of the top. To the top of the can and over the hole solder a bicycle tire or automobile tire valve. Attach a bicycle pump and then completely immerse the can in a pot or bucket of cold water. Pump can to about 20 to 25 pounds of pressure as indicated by a tire gauge. If seams are faulty, bubbles of air usually appear at the leaking point. Or you may take the cans to a garage and have a mechanic make the above test for you. However, the hot-water test described above is usually adequate.

Reflanging and Using Cans a Second Time.—Some home-sized can sealers are equipped with a can-opening roller and a reflanger. The manufacturer of the sealers have recommended that many cans may be reflanged and used a second time. However, experience has not been entirely satisfactory with this procedure owing to the difficulty of securing a perfectly airtight seal at point of union of side seam of can and the double seam on top of the can. Also many cans are considerably corroded by the can contents during the usual several months' storage in the pantry, and hence are unsuitable for use a second time.

On the other hand, an experienced and skillful operator may use some of the cans a second time if particular care is taken in opening the can, reflanging, and in adjusting the can-sealer base to the proper height. The booklet accompanying the sealer gives specific directions and illustrations for carrying out these operations.

GENERAL DIRECTIONS FOR CANNING

PREPARATION OF FRUITS

Nearly all fruits and vegetables require some kind of preparatory treatment before canning. This may be washing, sizing, sorting for color or ripeness, peeling, pitting, coring, or slicing. In some cases special machines or tools are necessary.

The Raw Materials.—With the exception of pears, fruits for canning are best if tree-ripened and canned as promptly after picking as possible. Fruit purchased in the markets of large cities is usually picked immature. It is therefore of poorer flavor than that which is tree-ripened, often lacks sugar, and may be more or less wilted or overripe. City housewives will rarely find such fruit either economical in price or equal to freshly picked ripe fruit in quality.

Sorting and Grading.—Moldy and soured fruit should be discarded —it is not only unfit for food but is more liable to develop botulinus poison if improperly sterilized.

Overripe, but sound fruit, should be used for jam rather than for canning.

If the canned product is to be sold, it should be carefully graded for size, color, and maturity into two or three grades. These may be designated first quality (finest and most nearly perfect specimens), standard quality (sound fruit of fair quality), and pie fruit (small, slightly blemished, or overripe fruit).

Washing.—Clean fruit is essential to success. Wash all fruit thoroughly before canning.

Hand-peeling.—If only small lots of fruit are to be canned, hand-peeling is the most practical method. A guarded knife, like that shown in figure 1, *A,* is desirable for soft fruits such as peaches and pears, while the knife shown in figure 1, *E,* is perhaps more satisfactory for peeling and coring apples.

Mechanical Peeling.—If a relatively large quantity of apples is to be canned, some form of mechanical peeler is desirable. Hardware stores can supply an inexpensive hand-power peeler for kitchen use. A more expensive type peels and cores, or peels, cores, and slices the apple in one operation. This is very useful for preparing apples for drying.

Mechanical peelers for other fruits are not very satisfactory.

Lye-peeling.—To lye-peel peaches or apricots, first prepare in an agateware or iron kettle (never aluminum) a lye solution of ¼ pound (4 ounces or about 6 level tablespoons) of ordinary granulated lye, in 2

gallons of water. Heat to boiling, and while actively boiling immerse the peaches (halved clingstones or whole freestones) or whole apricots in a wire basket in the boiling solution until the skin is loosened and partially dissolved. This will usually require 30 to 60 seconds. Remove and wash in water until skin and lye are removed. Rinse thoroughly in fresh water. Washing away the skin and lye under a jet of water from a faucet is much more effective and satisfactory than washing in still water. If the peels do not slip off easily, add a little more lye to the solution; if the lye cuts too deeply, immerse the fruit a shorter time. To avoid darkening, store the peeled fruit in dilute cold brine, about 2 rounded tablespoons of salt per gallon of water. *Lye added to a hot solution spatters and may cause serious burns; use care in adding it.* If the solution attacks the hands, rinse them in vinegar; this will neutralize the lye.

It will not be found worth while to attempt to lye-peel small lots of fruit, but the method will save a great deal of time if 50 pounds of fruit or more are to be peeled. Lye-peeled fruit should be canned at once or stored in cold dilute brine to avoid undue darkening.

Coring and Pitting.—Pears are peeled and cut in half, and the core is then removed by the knife shown in figure 1, *D,* or by means of a sharp teaspoon.

Dessert cherries are usually canned without pitting, but sour or sweet cherries intended for use in pies should be pitted before canning. A mechanical pitter, such as that shown in figure 13, is more convenient than the small pitters operated by the thumb and two fingers.

Clingstone peaches are difficult to pit unless the spoon shown in figure 1, *C* is used. To use this spoon, first cut the peach to the pit completely around the suture (crease). Insert the pitting spoon (also known as pitting knife) from the stem end of the peach until the point of the spoon rests at the blossom end of the pit. Rotate the spoon until one half of the peach separates. Then scoop the pit from the other half. Pitting is best done before peeling.

Freestone peaches and apricots need only be cut in half and the pit removed with the point of the cutting knife.

PREPARATION OF VEGETABLES

Most vegetables require thorough washing. This removes not only soil but also many of the microörganisms that cause spoilage. In addition to peeling, shelling, slicing, or other preliminary preparation, most vegetables are blanched, that is, parboiled in boiling water or steam.

Vegetables as purchased in city markets are usually too costly for home canning; commercially canned vegetables are much cheaper. Vege-

tables from the markets are also apt to be wilted and tough and are usually much more difficult to sterilize than vegetables direct from the garden. Only freshly gathered vegetables should be used for canning.

Tomatoes are readily peeled after immersion in boiling water for about 1 minute and chilling in cold water. The cores should be removed at the same time, but if possible without opening the seed sacs.

Beets require about 10 to 15 minutes' boiling or steaming to loosen the skin; sweet potatoes require a longer time. Other root vegetables are peeled by hand.

Mechanical peelers for vegetables are too costly for home use.

PACKING FRUIT

Most fruits may be packed into jars or cans after preparation and without previous blanching or cooking. They should be arranged to present a neat appearance in the jars.

Some fruits, unless cooked for a short time before packing, soften during sterilizing and give partially filled containers. Berries for this reason should be cooked with an equal weight of sugar before packing. This is best done by adding the dry sugar to the fruit in a preserving kettle, bringing to a boil, and boiling gently 3 to 4 minutes. The juice of the fruit forms a sirup with the sugar—usually an excess of sirup unless the mixture be allowed to stand overnight to permit absorption of the sirup by the fruit. It may then be packed and sterilized in the jars or cans.

Apples should be cooked in boiling water and apricots in boiling dilute sirup 3 to 4 minutes to soften them and cause shrinkage. They may then be packed hot. If this is not done, the jars will be only partially full after sterilization.

All fruits, in order to conserve can and jar space, may be cooked a short time with sugar and a small amount of water as shown in figure 14. Some home canners prefer this to the cold-pack method. The objection to it is that some fruits become broken and present a less attractive appearance than cold-packed fruit.

Cold-packing of the raw fruit is recommended for peaches, pears, plums, prunes, and cherries.

BLANCHING

Certain vegetables should be blanched or parboiled before canning. This is done by dipping them in boiling water or heating in steam. A wire screen basket or a frying basket, such as is used in cooking doughnuts, will serve to hold the vegetables while they are dipped in a large

cooking pot containing boiling water. This treatment improves the quality, by removing slimy substances and lessening the astringent taste of the skins. It is advisable with asparagus to remove bitterness. Blanching also softens the vegetables so that a larger amount may be packed into the jar or can. Blanching of peas, string beans, and greens such as spinach is better done in steam than in water because there is then less loss of water-soluble vitamins and valuable food materials.

When the vegetables are blanched in water, use this water, lightly salted, for filling the jars; this procedure retains much of the water-soluble vitamins and other food values removed by the blanch water.

Apples and apricots should also be blanched as described above in order than a full can may be obtained.

EXHAUSTING

This process is desirable with nearly all airtight containers which are to be sterilized by heat. It consists of a preliminary heating before sealing and before the final sterilization. It results in expanding the air inside the container and thus drives out most of the air. When the sealed container and its contents cool, the small amount of air still enclosed contracts and produces a partial vacuum. If cans are sealed while the contents are cool they will swell on heating, owing to the expansion of the heated air. In order to avoid breakage, jars should not be tightly sealed before sterilization at the boiling point. However, recently[8] it has been found that jars of vegetables to be heated in a pressure sterilizer should be heated to the boiling point and sealed tightly before closing the sterilizer in order that the liquid will not boil out of the jars during heating and cooling. Exhausting is not necessary because the lid permits escape of air and expansion of contents. The manufacturer recommends that lids of Kerr "self-sealing" jars be screwed on firmly before placing in sterilizer. If cans are packed with hot products, boiling hot sirup or brine added, and the can sealed at once, exhausting can be omitted. If merely warm or cold brine or sirup is added, the can should be heated in live steam or boiling water for at least 5 minutes before sealing.

SIRUPS

Fruits are canned in sugar sirups of various strengths or concentrations. The sugar so used has no preservative effect; it is used only for sweetening. Heating is what preserves the fruit. In general, the more acid fruits require the most sugar. The appropriate strengths are given in the directions for canning the various fruits.

[8] This new procedure has been found satisfactory by Miss Hilda Faust and others of the Home Demonstration Office.

At the time this edition goes to press sugar is scarce and subject to rationing. In another section, directions are given for canning without sugar or by methods requiring a minimum of sugar.

Brix or Balling Sugar Testers.—Sirups of the desired strengths may be made up by weighing the sugar and measuring the water, or by adding sugar to the water until the desired strength is indicated by the sugar tester or hydrometer. This is sometimes called a saccharometer and the commonest forms are the Brix and the Balling. The hydrometer is floated in a sample of the sirup contained in a tall, narrow metal or glass cylinder and the sugar percentage read from the scale at the surface of the liquid. If the sirup is cold the reading is correct enough for the purpose, but if very hot the reading may be several per cent too high (fig. 11). If large quantities of fruits are to be canned for sale the use of a hydrometer is recommended; but for the usual home canning of fruits it is not needed.

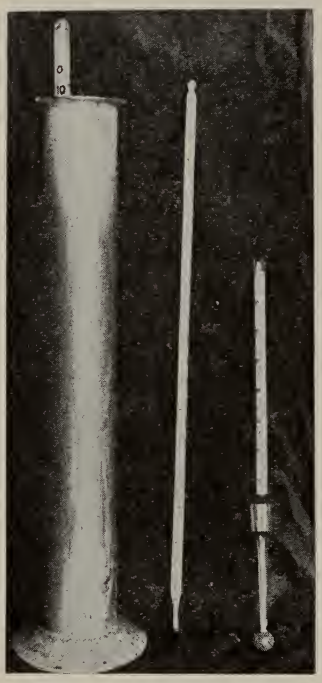

Fig. 11.—Cylinder, thermometer, and Balling sugar tester. The tester in the cylinder of sirup is read at the surface of the liquid. In the illustration this is approximately 12 per cent.

Baumé Sugar Tester.—This is a hydrometer similar in form to the Brix, differing only in the scale, which reads in degrees instead of per cent. The degrees may be multiplied by two to give the per cent approximately.

Strength of Sirups.—For all practical purposes sirups for home canning may be prepared without a hydrometer with the following proportions of sugar and water: light sirup, 1 cup of sugar to 4 cups of water; medium, 1 cup sugar to 2 of water; and heavy, 1½ cups of sugar to 1 of water.

The amounts of sugar to be added to 1 gallon of water to make sirups of the concentrations used in home canning are as follows:

Light sirup,	20 degrees Balling,	2 pounds 2 ounces
Medium sirup,	40 degrees Balling,	5 pounds 10 ounces
Heavy sirup,	60 degrees Balling,	12 pounds 10 ounces

In making the sirups the desired weight of sugar is added to 1 gallon of water and dissolved by warming and stirring. The volume of sirup obtained is greater than that of the water used. For 1 quart of water use

one-fourth the amounts of sugar noted above. Water may be used in place of sirup, for sugar is not necessary in home canning of fruits.

Cane and Beet Sugar.—In numerous tests made by the Fruit Products Laboratory, beet sugar was found to give results equal to those of cane sugar. The prejudice against beet sugar is no longer warranted. It is identical chemically with cane sugar. Beet sugar is equally as good as cane sugar for jellies and preserves and is used by many canners and preservers.

Adding the Sirup.—The sirup should be boiled, strained to remove solid impurities, and poured into the jar or can boiling hot (see fig. 12).

BRINES

For most canned vegetables a brine of about 2 per cent salt is used. This corresponds to about 2½ ounces or about 5 level tablespoons of salt per gallon of water. Unless otherwise directed, this brine, boiling hot, should be used to fill all cans of vegetables, except tomatoes and rhubarb.

STERILIZING AT THE BOILING POINT

For sterilizing at the boiling point the sterilizer containing the cans and several inches of water is placed on a stove, and steam generated by boiling the water heats the cans. See figures 14 and 15 for method of using this sterilizer.

Cans may be placed in two or more tiers, separated and supported by slat gratings which allow the steam to penetrate to all parts of every can. The cover of the boiler should fit snugly in order that the steam will be confined and heat the upper part of the sterilizer to the boiling temperature. A cloth should be placed between the cover and the top of the boiler if the cover does not fit tightly (see fig. 15). *The times of sterilization given for the various products are to be calculated from the time the water first boils. For the reasons given on page 7 the oven method of heating packed jars or cans of food is very unsafe and should not be used.*

STERILIZING UNDER PRESSURE

In using the pressure sterilizer about 3 inches of hot water is added. The water is previously heated to boiling. The sealed cans are then placed in the crate and lowered into the sterilizer. Glass jars are filled with the scalding hot vegetables and boiling hot brine and loosely sealed as directed for sterilizing at 212° F. The water is gently boiled with the release cock open for about 10 to 15 minutes for vegetables in brine and 15 to 20 minutes for corn, spinach, or other tightly packed products. Then the cooker is opened and the jars tightly sealed. This procedure

will prevent loss of liquid during sterilizing and will prevent breaking of jars. Instead of heating the jars to the boiling point in the pressure cooker they may be heated in a separate pot for the time indicated and then sealed boiling hot.

Heat is then applied until steam escapes freely from the open cock. This cock is then closed and heating continued until the temperature reaches the desired point. (See table 2.) At this point the safety valve should be set for the corresponding pressure. At the same time the release cock is opened slightly, so as to allow a small escape of excess steam. By this means the temperature can be regulated very closely. After reaching the temperature the cooker should be placed over a small flame so that escape of steam will not be too rapid. The safety valve will open and relieve the pressure if the temperature begins to go too high. For cans, when the heating has continued for the required time, the cooker is removed from the fire, the release cock opened full, and when the pressure has fallen to 0 the cans are removed and cooled in water. If the cooker is opened before the pressure has fallen to 0, steam may scald the operator. *For glass jars open the valve very slightly so that only a very small jet of steam escapes.* Opening the valve too wide will cause much of the liquid to boil out of the jars. As soon as the pressure has fallen to 0 the cooker should be opened. Remove the jars and tighten seals at once on those jars on which the tops have loosened during sterilizing.

The larger outfits of this kind are equipped with a small steam boiler for heating, and three or more cookers. Pressure sterilizers are usually operated at 5, 10, or 15 pounds' pressure, corresponding to 227°, 239°, and 249° F respectively.

Pressure gauges often become highly inaccurate and unreliable through use. Every home pressure sterilizer to be used for the home canning of vegetables should be equipped with a thermometer. Thermometers retain their accuracy well and are not affected by different altitude.

CAUTION! If the jars are not full when removed *do not* open them and add brine to fill. Such added brine is not sterile and may cause fatal poisoning later. Seal the jars at once whether they are full or not.

CLOSING AND COOLING JARS AND CANS

After the sterilizing period is completed in the 212° F sterilizer or after the pressure in the pressure cooker has fallen to 0 (with the release valve opened very slightly), remove the jars without in any way disturbing the seal on jars from the pressure cooker; screw or clamp the

tops tightly on jars sterilized in steam or in boiling water at 212° and invert the jars to cool in a room free from cold drafts. The exceptions to this rule are Economy and Kerr "self-sealing" jars, which are not inverted. Tops of Economy jars must be clamped tightly. *CAUTION!* Jars from a pressure cooker are apt to be under great pressure when the cooker is opened. Allow them to cool 10 to 15 minutes before handling them, otherwise one or more may burst and injure the operator.

Cans are sealed before sterilization, and are removed and chilled to about blood temperature in cold water after sterilization.

MARKING CANS AND JARS

All containers should be plainly marked with the variety and grade of the product. Cans may be marked by means of a small set of rubber stamps and canner's ink, which will stand hot water, or by means of a lead pencil. They may also be marked by means of a splinter of wood dipped in strong copper sulfate solution. Gummed labels do not stick well to tin. Jars may also be marked after sterilization with gummed labels or wax pencils specially made for writing on tin and glass.

All lots should be dated. Such labeling and records will be found valuable in locating cause of spoilage, should this occur.

STORAGE AND SPOILAGE

Before any canned fruit is put on the market, it should be stored at least a month to see if it will show spoilage. It is better to have cans spoil in the storeroom than on the grocers' shelves. If the fire used to heat the sterilizer is not hot enough, it may take too long to bring the cans to the temperature of boiling water and the organisms that cause spoilage may not be killed. Often, however, the trouble is due to leaks in the cans. With an inexperienced operator, leaks often occur around the seam of Sanitary cans or in the solder groove of the cap of solder-top cans. When the sealing operation is well done, there should be very few leaks. Leaks can be detected by bubbles appearing when the cans are placed into hot water. Leaks permit air to enter and the air brings with it the organisms which cause the fruit or other product to ferment or spoil and produce the gas that causes the cans to swell. Jars should be stored in a dark, cool place.

Spoiled cans or jars of food should never be tasted or used. They may contain *Bacillus botulinus,* and be deadly poisonous. Do not feed spoiled canned food to fowls or animals—it may poison them. Many cases of poisoning of chickens by spoiled home-canned foods are on record. See also discussion of food poisoning in a later section.

SPECIAL DIRECTIONS FOR FRUITS

In figures 14 and 15 is illustrated a method of saving sugar and jars. The fruit is cooked soft with very little water and no sugar; or is cooked with a small amount of sugar and then is canned hot and sterilized as illustrated. Precooking and no addition of liquid saves greatly on jars and sugar.

APPLES

Canned apples are used principally for pies. Any variety will do for this purpose, but canners in California are limited largely to Bellflower, Yellow Newtown, and Gravenstein, since these are the chief varieties grown in the state and available culls are chiefly of these varieties.

To prepare, peel, core, quarter, and blanch in boiling water or steam for 3 to 4 minutes. Pack hot, then fill the jar with boiling water, and process as directed in table 1.

Applesauce may be prepared in the ordinary way. Pack scalding hot into jars or cans. Sterilize as for canned apples.

PEARS

The Bartlett is the best variety for canning purposes. Fruit for canning is harvested while still green but after it has reached full size. It is allowed to ripen in boxes. The fruit is peeled by hand and cored with the coring knife shown in figure 1, *D*, or with a sharp spoon.

Since pears tend to turn brown rapidly after peeling, they should be placed in the can with sirup as soon as peeled, or should be kept under water or dilute brine (2 tablespoons of salt per gallon of water) after peeling until used. Pack into jars or cans and add hot medium or light sirup, or water. See table 1 for sterilization or prepare and can as directed in figures 14 and 15.

PEACHES

There are many varieties of peaches available for canning. Of the clingstone varieties, the Tuscan, various midsummer varieties, and Phillips Cling are very satisfactory; and of the freestones, the Lovell, J. H. Hale, Crawford, and Elberta are preferred.

Peel and pit as directed in the section "Preparation of Fruits." Pack in cans or jars and add hot medium or heavy sirup. See table 1 for further directions.

Peaches may be canned in plain sirup or in a sweet spiced vinegar made as follows:

Sugar	3 pounds	Ginger root	¼ ounce
Vinegar	1 pint	Whole cloves	½ ounce
Water	3 pints	Stick cinnamon	½ ounce

Bring this mixture to boiling. Let stand overnight to absorb spice flavor. Strain to remove spices, reheat to boiling, add hot to the fruit in the jar or can, and sterilize according to table 1.

If sugar and jars are scarce the fruit may be prepared and canned as directed in the hot-pack method shown in figures 14 and 15.

APRICOTS

Apricots for canning should be ripe and well colored, but not too soft. If overripe, the fruit cooks down to a jam of unattractive appearance. Blanching for 3 to 4 minutes in boiling sirup before packing is desirable, so that the container will be full after sterilizing.

Apricots require a heavy sirup to bring out their best flavor. See table 1 for further directions. To save sugar and jars, prepare and can as shown in figures 14 and 15.

Fig. 12.—Funnel for filling fruit and sirup into jars.

PLUMS

This fruit is canned whole. On account of the high acidity of the plum, glass is to be preferred to tin.

The fruit should be picked when it is beginning to turn soft. As with apricots, blanching before canning is desirable. Pack in cans or jars and add a medium or heavy sirup. See table 1 for sterilization; or prepare and pack as shown in figures 14 and 15. Some plums are freestone in character, and such varieties may be halved and pitted before canning.

FRESH PRUNES

Fresh California prunes are not canned commercially, but are perhaps preferable to dried prunes for home use. Select well-colored ripe prunes of large size. Wash and place in cans. Add medium sirup (40 per cent) hot. See table 1 for sterilization.

CHERRIES

Cherries canned without pitting develop a "bitter almond" or "pit" flavor, pleasing to some and disagreeable to others. Inexpensive, small

hand-pitting machines can be obtained from most hardware stores (fig. 13). The Royal Anne (Napoleon), a large white cherry, is seldom pitted. Cherries tend to shrivel in heavy sirups or if the sirup is added hot. Only moderately sweet sirups should be used, therefore, and the cans exhausted by heating in boiling water or steam for 5 minutes before sealing. See table 1. To save sugar, pitted cherries may be packed as shown in figures 14 and 15.

Fig. 13.—Small hand-power cherry pitting machine for home use.

STRAWBERRIES, BLACKBERRIES, LOGANBERRIES, AND RASPBERRIES

Strawberries, blackberries, loganberries, and raspberries shrink during cooking and the fruit which fills a can when fresh will shrink to about two thirds or less after sterilizing. If the cans are to be well filled, the berries must first be cooked. The general procedure for precooking and subsequent canning is illustrated on pages 33 and 34.

To each pound of fruit add 1 pound or less of sugar, according to the ripeness of the fruit. Boil with gentle stirring for 3 to 4 minutes. Pack into cans or jars, scalding hot. Seal cans. Sterilize cans at the boiling point for 5 minutes. Glass jars or lacquered cans must be used for all berries, because plain tin bleaches the color of the fruit. The extra sirup formed by the juice of the fruit can be used on the next lot or the excess

moisture may be boiled off and the fruit made into a preserve before canning.

An alternative method is to cook with sugar, as directed, and store overnight to allow the berries to absorb excess sirup. Next day heat to boiling, and proceed as above.

CURRANTS, CRANBERRIES, AND GOOSEBERRIES

These fruits are used only for pies, jellies, and jams, and are not commonly canned. They may be put up in enameled cans or in jars in plain water and sterilized at 212° F for 10 minutes. No sugar need be used, although the flavor of the fruit is better if canned in sirup instead of water. (See table 1.) An alternative method is to convert them to sauce or jam; can or pack hot in jars, and sterilize 10 minutes at the boiling point.

GRAPES

Muscat and seedless grapes are canned commercially in considerable quantities in California. The grapes are removed from the stems and graded for size and appearance. Pack in cans or jars and add medium or light sirup. The canned fruit is used for pies. (See table 1.) Tokay grapes may be canned in the spiced sirup given for peaches.

FIGS

The fruit should be used firm-ripe and must be handled carefully during picking and transferring to the cannery.

In commercial canning, figs are graded, washed, and then blanched 3 to 4 minutes in hot water. They are then placed in the cans in a very heavy sirup (60° Balling) and are cooked in the sealed cans for about 2 hours at the boiling point. This method may be used in the home also (see table 1). Or they may be packed as shown in figures 14 and 15, but must be sterilized for 1½ hours in the jar at the boiling point.

RHUBARB

From a culinary point of view, rhubarb is like a fruit and is very easily sterilized and canned in the same general way as fruits. Since it is used chiefly as pie stock no sugar need be used.

Wash the stalks, cut into short lengths, and place in a stewpan with a little water. Boil until soft. Pack boiling hot into cans or jars and seal. See table 1 for sterilizing time. Some prefer to cook the rhubarb with about 1 cup of sugar to 2 cups of rhubarb before canning.

Tin cans are soon badly corroded by rhubarb and only glass should be used.

GRAPEFRUIT

Grapefruit is now canned in large quantities in Puerto Rico and Florida. Use only thoroughly ripened fruit. Peel. Separate the segments and peel these. Pack the peeled segments into jars or cans. Add a boiling hot sirup of 50° Balling. See table 1 for sterilization.

FRUITS WITHOUT SUGAR

To pack fruits without sugar place the prepared fruits in jars or cans. Fill with hot water and proceed as directed for canning fruits with sirup. Sterilize as directed in table 1.

JELLY JUICES

Boil jelly fruits as for jelly making. Berries and currants are crushed, boiled 5 minutes without addition of water. Apples are sliced without previously peeling; enough water is added to prevent scorching and the fruit is boiled until soft, usually 15 to 20 minutes. Press the boiled fruit and strain the juice. Heat the juice to boiling; pack into scalded jars and sterilize as directed in table 1. Cans are not recommended for jelly juices made from red fruits but are satisfactory for apple and other white juices.

Crown-capped bottles may be used instead of jars if desired. (See Extension Circular 65, cited in footnote 5.)

To use the jelly juice at a later date simply drain the juice carefully from the sediment in the jar, add the customary amount of sugar, and boil until the jellying point is reached.

FRUIT JUICES

See Extension Circular 65 (footnote 5, p. 4) for the preparation and preservation of fruit juices in the home, and Circular 344[9] for the commercial preparation of fruit juices.

RIPE OLIVES

The Mission variety is best for home pickling, although the Manzanillo is also fairly satisfactory. The Sevillano and Ascolano varieties are very difficult to pickle and should not be used by those unfamiliar with the pickling of ripe olives.

Picking.—Pick the olives after they have acquired a light pink to red color, and, if possible, before they have become jet-black and overripe. Avoid bruising and prolonged storage in boxes before pickling.

[9] Joslyn, M. A., and G. L. Marsh. Utilization of fruit in commercial production of fruit juices. California Agr. Exp. Sta. Cir. 344:1–63. 1937.

Holding Solution.—If, for any reason, it is necessary to ship the olives a great distance or to store them for a week or longer before pickling, cover them in suitable containers with a 5 per cent salt solution (about 4¼ pounds of salt to 10 gallons) for 3 or 4 days. Then cover them with a brine of about 12 per cent salt (about 12½ pounds of salt to 10 gallons of water) and keep the olives submerged in this solution until used. However, the olives will usually be pickled direct from the tree.

Two-Lye Process.—The first lye treatment is to facilitate darkening of the color. Prepare a lye solution of about 1¼ to 1½ per cent; this is approximately 1½ to 2 ounces of granulated lye per gallon of water, or approximately ½ to ¾ pound to 5 gallons of water. If the olives are tender, use not more than 1 ounce of lye per gallon of water.

Cover the olives in a stoneware jar or wooden container with this lye solution. *Never use galvanized iron containers for the zinc of the coating is dissolved by the lye and renders the olives poisonous.* Stir every half hour and carefully observe the progress of the lye action. The color of the skins will change as the lye penetrates the olives. Cut two or three olives lengthwise occasionally and when it is observed that the lye has penetrated through the skins of practically all of the olives and a short distance (1/64 to 1/32 inch) into the flesh of some of them, remove and discard the lye solution. With lye at 60° to 65° F the time required is usually 4 to 6 hours. With tender-skinned olives or at higher temperatures less time may be required, and with tough-skinned olives and lower temperatures more time.

Leave the olives in the jar or tub and stir three times daily to facilitate darkening of the color by oxidation. In order to avoid bruising, large tubs of olives may be filled with water at the time of stirring and the water drawn off after stirring. In small containers the fruit may be stirred with the hands without adding water. Normally, 4 to 5 days' exposure to air is required to give the desired color.

The second lye treatment is to remove bitterness. Prepare a solution of 1 ounce of lye per gallon of water and place it on the olives. Stir them occasionally (about once an hour). Cut two or three olives now and then and carefully observe the lye action; it causes the flesh to darken slightly in color; or, a drop of phenolphthalein solution (a small bottle of which may be obtained at the drug store) will develop a red color to the depth of the lye penetration. If this solution is used, rinse the lye from the olives in water before cutting them for the test. Leave the olives in the lye solution until it completely reaches the pits of the fruit (usually 8 to 16 hours at 60° to 65° F). If the lye fails to reach the pits in 24 hours, replace it with a fresh lye solution.

When the lye has reached the pits of the olives remove and discard it. Cover the olives with water and leave them submerged.

Change the water three times daily until all taste of lye is removed or until the cut surface will no longer cause the test solution (phenolphthalein) to turn red or pink. Normally, 7 days' soaking in water is required.

Curing in Brine.—The olives at this stage are edible but require salt to bring out their flavor. Store the olives for 3 days in a brine of about 4 ounces (¼ pound) of salt per gallon of water. They are then ready for serving or canning.

Canning and Sterilizing.—Pack into cans or jars. Add boiling hot brine of 4 ounces (¼ pound) of salt per gallon. Seal the cans. Place the scalded rubbers and caps on the jars.

Sterilize as directed for vegetables in a pressure cooker at 240° F for 60 minutes (10 pounds' steam pressure).

The State Board of Health has ruled that all olives offered for sale must be sterilized in this manner under the personal supervision of a state inspector.

Color.—Attaining a black color is difficult and is largely a matter of skill and experience. Even in commercial olive canneries much of the fruit after pickling is brown rather than black in color. The brown fruit is equally as nutritious as the black and usually of better flavor. Brown color is usually due to too severe lye treatment.

One-Lye Process.—The preceding process produces olives of dark color. If this color is not desired, a lighter-colored product of superior flavor may be prepared by a single treatment.

In using this process, cover the olives with a lye solution of 2 per cent (2½ ounces of lye per gallon of water) and allow it to stand with occasional stirring until the lye penetrates completely to the pit, normally 9 to 15 hours.

Remove the lye. Cover the olives with water. Change the water three times daily until all taste of lye is removed (6 to 7 days).

Cure in brine, can, and sterilize as directed for the two-lye process.

Preserving Olives by Brine.—Instead of canning and sterilizing, the olives may be kept several months as follows: After pickling, store them one week in a brine of ¼ pound of salt to the gallon. Then store in a fresh brine of ½ pound of salt per gallon for one week. Similarly one week in a brine of ¾ pound of salt per gallon. Then store, until used, in a brine of 1 pound of salt per gallon, changing the brine once a month; store in a cool place. When the olives are to be used soak a small quantity overnight in water to remove excess salt.

HOT PACK TO SAVE SUGAR AND JARS

In figures 14 and 15 are given in illustrated form full directions for packing fruits without sugar or with little sugar by the hot-pack method.

Preparation of the fruit.— Wash, sort, and prepare the fruit as for cooking. Remove peel, cores, and pits; cut or slice as desired. Cook as soon as possible after cutting. To prevent darkening, cut apples and pears should be kept in water until cooked.

Heating and cooking with sugar.—Place the prepared fruit in a pot and then add dry sugar, ¼ to ½ pound per pound of fruit, or with very sweet fruit, none. Add a little water to firm fruits to avoid scorching. Add no water to berries. Heat to scalding temperature. Do not cook till soft. Peaches, pears, cherries, grapes, and some other firm fruits may be cooked longer than berries or soft fruits.

Filling the jars. — Warm the jars with hot water, and ladle the hot fruit into them through a funnel until they are filled to within ¼ inch of the top. Avoid getting juice on the outside. The neck should be dry and clean. Or pack uncooked firm fruits into jars cold. Add boiling water or hot sirup and proceed as directed on next page.

Fig. 14.—Preparing fruits for modified hot-pack process. This method allows more fruit per jar.

Placing rubbers and covers.—Test clean, scalded rubbers by bending and stretching. They should not crack. Put evenly in place on the necks of the jars, then apply the covers, placing or screwing them loosely; then lower the jars into the sterilizer, placing a piece of wire screening or other false bottom in the bottom of the boiler.

Sterilizing in a wash boiler.—Have a few inches of hot water around the jars. Apply the cover of the boiler. Unless the cover fits very well place a cloth beneath it. Heat until steam comes freely from beneath the cover and then in addition for the time specified in table 1.

Removal from the boiler.—Remove immediately. Handles on the wire screen bottom or wire baskets to hold the jars facilitate removal. A cloth or a wire jar lifter may be used. The lifter in the illustration serves well for lifting jars and as a false bottom. Place hot jars on wood or paper to avoid cracking.

Tightening the covers.—Tighten the covers immediately and stand the jars upside down. This insures the sterilization of the covers. Leaky jars can be detected by air bubbles entering during cooling. Do not invert Economy jars or Kerr "self-sealing" jars.

Fig. 15.—Sterilizing and sealing jars of fruit.

SPECIAL DIRECTIONS FOR VEGETABLES

Most vegetables have only a small amount of acid as compared with fruits. This low degree of acidity, as we have seen, permits the growth of certain bacteria which are very difficult to kill by heating. Vegetables, therefore, are hard to sterilize. Tomatoes, which resemble fruit in acidity, are an exception.

Usually in sterilizing vegetables temperatures above 212° F are necessary. This requires the use of a steam-pressure cooker. The oven method is very unsafe and dangerous. Either cans or jars may be used for vegetables. If jars are used it is recommended that they be filled with the scalding hot vegetable and boiling hot brine. Then heat jars in boiling water or live steam for 10 minutes for peas, string beans, asparagus, carrots, beets, and other loosely packed vegetables; and 15 to 20 minutes for spinach, corn, sweet potatoes, and other tightly packed products. Then seal the jars, place them in the pressure cooker and sterilize for time given in table 2.

Where a pressure sterilizer is not available, it is advised that vegetables be dehydrated or pickled in brine. If properly acidified, vegetables can be sterilized safely in jars or cans in boiling water; but this method is recommended only for commercial canneries or such community canneries as are supervised by some one with technical training. In such cases, directions may be obtained from the Fruit Products Division, University of California, Berkeley. A leaflet describing the construction and operation of an inexpensive home-sized evaporator for fruits and vegetables and another giving directions for pickling vegetables in brine are obtainable free of charge from the Agricultural Extension Service, College of Agriculture, Berkeley.

ARTICHOKES

Young artichokes only are used. The hard tip is trimmed off and some of the outer bracts removed, leaving only the tender parts.

They are blanched for 5 minutes in boiling water, acidified with ¾ measuring cup of lemon juice or vinegar per gallon, placed in cans or jars, and covered with hot brine made of 3 level tablespoons of salt, ¾ cup of vinegar or lemon juice, and 1 gallon of water. Unless only a few artichokes are to be canned it will be desirable to make up fresh brine to be added to the jars, rather than to use the liquid from blanching, for this will be cloudy and is apt to be disagreeable in flavor. For sterilization see table 2. During the present emergency it would seem good policy to can more nutritious vegetables than artichokes, such as peas, corn, and green beans.

ASPARAGUS

Green asparagus is of higher nutritive value than the white, but either green or white is satisfactory for home canning. Grade into large, medium, and small sizes. Cut into lengths to fit the container. This is conveniently done by making a small box ¼ inch less than the depth of the can or jar and open at the top and one side. The bud ends of the stalks are placed in the box against the closed end and the butts protrude from the open end. They may be cut off flush with the edges.

Blanch in boiling water for about 4 minutes. Pack into jars or cans with the tips up. Fill with hot brine. Heat jars 10 minutes in boiling water. Seal cans or jars. Sterilize as directed in table 2.

GREEN BEANS

Green beans are best for canning when very young and tender; the larger and harder the pods and beans become, the lower their value for canning. Commercially, beans are usually put up in no. 2 cans.

Snip or string after sorting. The larger sizes should be cut into pieces about 1½ inches long, while the small no. 1 grade may be canned whole.

Blanch the no. 1 grade 2 minutes in a small amount of boiling water and the larger grades for 5 minutes. Fill into cans or jars hot. Cover with hot brine made of water in which the beans were blanched. Heat jars 10 minutes in boiling water. Seal cans and jars tightly. Place in pressure sterilizer. Sterilize cans or jars as directed in table 2.

BEETS

Beets should be small and turnip-shaped if canned for market. The first grade may be 1 to 1½ inches in diameter and the second over 1½ inches. The large beets are quartered or sliced after peeling.

Scald in boiling water or in steam until the skin will slip easily, usually about 15 minutes. Chill in cold water, peel, trim, and fill into enamel-lined cans or glass jars. Fill cans with hot brine, and seal. Fill jars with hot brine. Heat in boiling water 15 minutes. Seal. Sterilize as directed in table 2.

CARROTS

Grade for size and color. Wash and scrape. Quarter lengthwise or cut crosswise. Precook in a small amount of water 3 to 5 minutes in an uncovered pan. Pack. Cover with water in which they were cooked. Add one teaspoon of salt to each quart jar. Heat jars in boiling water 10 minutes. Seal. Place in pressure cooker. Sterilize jars or cans as directed in table 2.

SWEET CORN

Only *young* tender ears of good varieties of sugar corn should be used. The corn must be fresh if good results are to be expected. Husk the ears and cut the corn from the cob. Make a sweetened brine of ½ pound (one measuring cup) of sugar and 1½ ounces (4 level tablespoons) of salt to 1 gallon of water. Mix the corn with a small amount of brine (enough to cover the corn) and heat in a pot to boiling.

Fill scalding hot into jars. Heat in boiling water 10 to 15 minutes. Seal. Place in pressure cooker and sterilize as directed in table 2. Cans are filled scalding hot, sealed at once, and sterilized as directed in table 2. Cool the cans in cold water after sterilizing.

PEAS

Picking and hulling peas by hand is a very slow process and not to be recommended for commercial canning. Large canneries do the hulling, grading, blanching, and filling of cans entirely by machinery. It is feasible, however, to shell by hand enough peas for canning for home use. Use only fresh, tender peas.

Place the shelled peas in a small amount of water and boil long enough to wrinkle the skins slightly, usually about 2 to 4 minutes, according to the size and tenderness of the peas.

Fill into cans or jars and cover with the hot water in which they were blanched. Add 1 teaspoon of salt and 3 of sugar to each quart jar or can. Seal cans hot. Heat jars in boiling water 10 minutes. Seal. Sterilize as directed in table 2.

PEPPERS, PIMIENTOS

These vegetables are usually peeled by causing the skin to separate by roasting or by immersing in hot oil. They can be peeled successfully by immersing from 2 to 3 minutes in cottonseed oil heated to smoking. They are then chilled at once in cold water, and the skins come off easily from the large peppers and pimientos. Small, pungent, tough-skinned Mexican peppers do not yield so well to this treatment. When peeled in this way, the peppers are soft and pliable and can be folded into the cans after removing stems and seed cores. The peppers or pimientos may also be peeled by roasting in a gas flame or in a very hot oven until the skins will separate.

Pack the peeled product into cans or jars. Fill with boiling water or brine. Sterilize in boiling water for 40 minutes. For the flavoring of stews and other cooked dishes, it will be found that home dried peppers are very satisfactory. See unnumbered wartime leaflet on drying foods in the home.

NEW POTATOES

Peel, pack in jars or cans. Fill with dilute brine, containing 2 per cent salt or about 1 level teaspoon per quart of water. Heat the cans in steam or boiling water 5 minutes and seal them. Handle jars as with string beans or peas. Sterilize quart and smaller containers at 240° F (10 pounds' pressure) for 40 minutes and 2 quart size jars, or no. 10 cans, for 60 minutes.

PUMPKINS

Scrape out fibrous pulp and seeds, and cut the flesh and rind into strips. Boil in water until soft. Scrape the flesh from the rind and press through a colander. Boil to the desired consistency. Pack hot into cans and seal. In using jars pack hot; heat jars in boiling water 20 minutes. Seal. Sterilize in pressure cooker as directed in table 2.

TOMATOES

Tomatoes have a considerable amount of acid which checks the growth of heat-resistant bacteria. They are, therefore, easily sterilized at 212° F, and jars may be used satisfactorily.

For canning purposes, the variety used should be smooth and of a deep-red color. Corrugated tomatoes are too difficult to peel. The San Jose Canner and the Stone are excellent canning varieties.

Sort the tomatoes and reject those which are spoiled and underripe. Place them in a blanching basket and immerse in boiling water long enough to crack and loosen the skin, usually about ½ to 1 minute. Remove and chill in cold water. Slip off the skins and remove the cores. Pack the tomatoes tightly into jars or cans and fill with juice; or heat to boiling in the juice obtained in coring, and pack tightly into cans while hot, and seal. If packed cold in cans, the filled cans should be heated in boiling water or live steam for 5 minutes before sealing. Sterilize as directed in table 1. Tomatoes grown in hot sections may require longer sterilization, namely, 60 minutes in jars and 45 minutes in cans.

If the tomatoes are packed without the addition of juice, the produce is known as "solid pack"; if juice is added, as "standard pack."

Tomatoes may be canned whole to be used for slicing for salads, although they will soften somewhat during sterilizing. Select small tomatoes that will go into the jars or the cans. Cover with a hot tomato juice pressed from crushed fresh tomatoes. Seal. Sterilize as directed in table 1.

Tomato Puree and Hot Sauce.—Tomato puree or sauce is very convenient for flavoring many dishes, such as stews, soups, and macaroni. Cook tomatoes until soft. Rub through a fine screen to remove skins,

seeds, and fiber. Concentrate the puree to about one half its original volume by boiling. Pack boiling hot into cans or jars and seal the cans. Sterilize as directed in table 1. If a hot sauce is desired, add—according to taste—salt, chopped onions, and hot peppers to the tomatoes before cooking and screening.

Tomato Juice.—To retain vitamin C in home-canned juice, tomatoes must be cooked before preparing the juice. Heat fully ripe tomatoes in steam or boiling water until cooked through, usually 8 to 10 minutes. Rub through a screen to separate the juice and red pulp from the seeds and skins. Be sure to obtain most of the red pulp, because it contains vitamin A. Pack hot in jars or cans and sterilize as directed in table 1. Fuller directions for the home preparation and preservation of tomato juice will be found in the wartime leaflet on fruit juices obtainable from the Home Demonstration Agent in your county. (See also Extension Circular 65.)

SUMMER SQUASH AND ZUCCINI

Wash, trim, cut in pieces as for cooking. Blanch in boiling water 3 minutes. Pack. Fill with boiling water. Sterilize as directed in table 2.

SWEET POTATOES

Wash. Boil or steam until the skins will slip easily. Peel quickly and pack hot. Fill the cans as tightly as possible, and seal. Or fill hot into jars, heat in boiling water for 30 minutes, and seal. Sterilize in pressure cooker as directed in table 2. After removal from sterilizer, cans should be chilled at once in cold water, but jars are allowed to cool naturally.

SPINACH AND OTHER GREENS

Can as soon after picking as possible. Trim off stems and imperfect portions. Wash thoroughly to remove all dirt. Heat in open pot with very little water until well wilted. Fill scalding hot into jars. Salt the water lightly in which cooked and add to jars. Heat jars in boiling water 10 to 15 minutes. Seal. Pack hot into cans; fill with liquid as above; seal. Sterilize as directed in table 2.

OKRA

Okra, or gumbo, is grown frequently in the hot sections of the state for flavoring soups, stews, and other dishes. The pods resemble green peppers in appearance.

Use only the young, tender pods for canning. Remove the stems. Blanch 6 to 8 minutes in boiling water. Pack into cans with boiling water. Sterilize as directed in table 2.

CONCENTRATED SOUP MIXTURES

Vegetables such as carrots, onions, tomatoes, beans, etc., may be prepared as for vegetable soup and canned. A recipe recommended by the United States Department of Agriculture is as follows:

A good combination consists of 1 quart of screened concentrated tomato pulp (boiled tomatoes screened and two volumes of pulp boiled down to one volume), 1 pint of green corn or tiny lima beans, 1 pint of okra or sweet peppers, 1 small onion chopped, ½ cup of chopped sweet red pepper, 1½ teaspoonfuls of salt, and 3 teaspoonfuls of sugar. Cook the tomatoes, pepper, and onion; put through a sieve to remove seeds; and cook down to about the consistency of ketchup. Measure, add the corn or beans and okra, which have been prepared as for canning. Add the seasoning and cook all together for 10 minutes. Pack at once into hot jars, and process 50 minutes at 240° F. Tin cans should be plunged immediately into cold water after processing at 250° F for 40 minutes and cooled as quickly as possible. When cool, store in a dark, dry, cool place.

If all of the vegetables recommended are not available, others may be substituted, such as cooked white beans for corn, pimientos for okra, white potatoes for lima beans. Celery makes a valuable addition to the mixture. When used for soup the canned product is diluted with water and flavored with bouillon cubes or meat broth. For convenience it should be put up in small containers.

PRESERVATION OF MEATS

Meats, owing to their texture and absence of acidity, are even more difficult to sterilize than vegetables. If incompletely sterilized, they may be attacked by certain heat-resistant bacteria which produce dangerous poisons. Because of this difficulty and danger, it is recommended that in the home, meats and fish should be preserved by salting or by salting and smoking, unless first done under the personal supervision of your Home Demonstration Agent and according to mimeographed directions obtainable from her. Directions for salting and smoking meats are given in Farmers' Bulletins 1186 and 1415, obtainable free of charge on application to the United States Department of Agriculture, Washington, D. C. Directions for the salting and smoking of fish are obtainable from the United States Bureau of Fisheries, Washington, D. C. However, there is some danger of botulinus poisoning from improperly prepared smoked fish. Therefore, home-smoked fish should never be tasted until thoroughly cooked. See your Home Demonstration Agent for further advice on the preservation of meats. It is also practicable to dry lean meats free of fat in the home evaporator, as described in the wartime leaflet on home drying of foods. It is also obtainable from your county Home Demonstration Agent.

CONDENSED DIRECTIONS

Tables 1 and 2 give brief directions for preparation and safe periods of sterilization for home-canned products.

Lengths of time for sterilizing in boiling water given in table 1 are designed for altitudes from sea level to 1,000 feet. *For altitudes above 1,000 feet, the length of sterilization in boiling water should be increased about 20 per cent (one-fifth) for each additional 1,000 feet.* See table 3.

Some pressure gauges are also affected by altitude; therefore, the pressure indicated in table 2 should be increased 1 pound for each 2,000 feet increase in elevation. As stated elsewhere, it is recommended that a thermometer be used on pressure sterilizers and that temperature, not pressure, be used as a guide. Pressure gauges are often inaccurate after long use. Thermometers retain their accuracy and are not affected by altitude. Sterilize 2-quart-sized jars 1½ times as long as quart jars.

VITAMINS IN CANNED FOODS

Until a few years ago it was considered that a satisfactory diet need contain only proteins of suitable composition, carbohydrates (sugars and starch), fats, inorganic salts, and water. At present, however, it is recognized by all authorities on nutrition that in addition to these necessary food constituents a complete diet must include the vitamins.

The vitamins are different from the other food constituents in that they do not furnish energy nor form tissue, but serve in the utilization of food in much the same manner that a spark plug serves an engine in its utilization of gasoline. Vitamins are necessary not only for health and vigor but for life itself. In the absence of vitamins normal growth and life functions cease or become greatly altered.

Authorities differ to some extent in regard to the exact number of vitamins and some of their properties, although most agree that the six most important vitamins are those to which have been given the designations A, B_1, C, D, E, and nicotinic acid. The vitamin formerly designated as F is at present termed B_1.

Vitamin A.—If vitamin A is absent from the food, normal growth is retarded and the general health is lowered. In experimental animals, deficiency of this vitamin is evidenced by the onset of an eye disease, xerophthalmia. Death ensues if the deficiency is severe and sufficiently prolonged. Vitamin A is fat soluble and growth promoting.

It occurs in abundance in whole milk, butter, cod-liver oil, liver, ice cream, and as carotene in most vegetables, both canned and uncanned. It is very abundant in leafy vegetables, carrots, and in tomatoes. Prunes

TABLE 1

CONDENSED DIRECTIONS FOR CANNING OF FRUITS, RHUBARB, TOMATOES, AND PIMIENTOS

Variety	Preparation	Sirup* recommended	Minutes sterilization in boiling water or steam at 212° F†	
			Quart jars	Quart cans no. 2½
Apples	Peel, core, quarter, and blanch 3-4 minutes	Water	15	12
Apricots	Halve and pit; blanch in medium sirup 3-4 minutes	Medium or heavy; 40° or 60° Bal.	25	15
Berries, all varieties	Boil 3 minutes with equal weight of sugar; stand 24 hours, pack hot	In own sirup	15	10
Cherries, sweet	Stem; pit if desired	Medium or light; 40° or 20° Bal.	30	20
Cherries, sour for pie	Stem and pit	Water	30	20
Figs (preserved)	Equal parts sugar, fruit, and water cooked to preserves; can hot	In own sirup	60	50
Figs in sirup‡	Sort and wash	Very heavy; 60°-65° Bal.	120	120
Grapes, Muscat and Seedless	Stem	Medium or light; 40° or 20° Bal.	20	15
Peaches, clingstone, Phillips Cling	Halve, pit, and peel	Medium or heavy; 40° or 60° Bal.	35	30
Peaches, freestone and Tuscan	Halve, pit, and peel	Medium or heavy; 40° or 60° Bal.	25	20
Pears	Peel, halve, and core	Medium or light; 40° or 20° Bal.	30	25
Pimientos	Roast and peel	Water or light brine	40	35
Plums	Sort, stem, and wash	Heavy or medium; 60° or 40° Bal.	20	10
Prunes, fresh	Wash, sort	Medium; 40° Bal.	30	20
Rhubarb	Wash, cut, and stew until soft; pack hot; no sugar	In own juice	15	10
Tomatoes§	Scald, cool, dip, peel, and core	In own juice	45	35
Tomato puree and juice	Boil soft, screen, boil to ½ volume and can hot	In own juice	20	15
Jelly juices	Boil fruit; press and strain juice as for jelly making; can hot	In own juice	15	10
Fruit juices	(See Extension Circular 65)	..	..	..

* Sirups: for convenience, sirups are classified as: light, 1 cup of sugar to 4 of water; medium, 1 cup of sugar to 2 of water; and heavy, 1½ cups of sugar to 1 of water.

† For altitudes above 1,000 feet see table 3.

‡ Because of difficulty of sterilizing it is recommended that figs be dried or made into preserves or jam instead of being canned.

§ Tomatoes grown in hot areas usually require 60 minutes and 45 minutes, respectively, for jars and cans.

TABLE 2

CONDENSED DIRECTIONS FOR PREPARING AND STERILIZING VEGETABLES AND OLIVES

(For brines see special directions for each product)

Variety	Preparation	Minutes sterilization at 240° F (10 lbs. pressure) for cans and jars*
Artichokes	Blanch 5 minutes in water with ¾ cup vinegar per gallon. Can in fresh brine of ¾ cup of vinegar and 3 tablespoons of salt per gallon of water	15
Asparagus	Sort, cut, and blanch 3-6 minutes	25
String beans	Snip, cut, and blanch 2-10 minutes	30
Beets	Parboil, peel, and cut	30
Carrots	Wash, scrape, cut, and blanch 3-5 minutes	40
Corn	Cut from cob	90
Greens and spinach	Trim, wash, and blanch 5 minutes	75
Olives, ripe	Pickle, as directed on page 31	60
Okra (gumbo)	Cut, and blanch 6-8 minutes	40
Peas	Blanch 2-4 minutes	40
Pumpkins and squash	Cut; remove seeds and "rag"; cook; scrape from skin; pack without brine	90
Summer squash and zuccini	Wash, cut, and blanch. Can in water	60
Sweet potatoes	Cook; peel; pack solid without brine	90
Vegetable soup mixture	See special directions, page 40	50

* The table is for no. 2½ or smaller cans and for quart or smaller jars. For no. 10 cans and 2-quart jars increase the time by one half. Thus if the time for quart jars is 60 minutes use 60+30 or 90 minutes for 2-quart jars.

TABLE 3

APPROXIMATE STERILIZING TIMES AT BOILING POINT AT VARIOUS ALTITUDES*

Product	Minutes at boiling point at various elevations in quart jars				
	0–1,000 feet	2,000 feet	3,000 feet	4,000 feet	5,000 feet
Apples	15	18	21	24	27
Apricots	25	30	35	40	45
Berries	15	18	21	24	27
Cherries	30	35	40	45	50
Figs, preserved	60	70	80	90	100
Figs, canned in sirup	120	145	165	190	215
Grapes, Muscat and Seedless	20	25	30	35	40
Peaches, Phillips Cling	35	40	48	55	60
Peaches, free and Tuscan	25	30	35	40	45
Pears	30	35	40	45	50
Pimientos	40	50	60	70	80
Plums	20	25	30	35	40
Prunes, fresh	30	35	40	45	50
Rhubarb	15	18	21	24	27
Tomatoes	30	35	40	45	50
Tomato puree	20	25	30	35	40
Jelly juices	15	18	21	24	27

* The times given in the table are for quart jars. For no. 2½ cans use 3 minutes less than the times given in the table. For no. 10 cans and for 2-quart jars increase the times by one-half; thus if the time for quart jars is 20 minutes use 20+10, or 30 minutes, for 2-quart jars.

and apricots are also sources of vitamin A. Canning and sterilizing do not materially reduce its potency; thus canned vegetables, such as spinach and tomatoes, are practically as rich in this vitamin as the corresponding fresh vegetables. Drying reduces somewhat the quantity of vitamin A in vegetables, but the dried vegetables still retain much of their original content of vitamin A. This vitamin differs generally from the others in that it is stored in the body, particularly in the liver, for future use.

Vitamin B_1.—A common disease in the Orient, beri beri, is caused by lack of vitamin B_1. Rice prepared for the market is polished; that is, the bran is removed mechanically and with the bran goes this vitamin. The discovery of the relation of this disease to the lack of some constituent of the rice bran led to extensive investigations on this, as well as other vitamins. A diet poor in vitamin B_1 causes loss of appetite, constipation, loss of weight, and a tired feeling.

Fowls are used as experimental animals in studies on vitamin B_1 because they soon develop polyneuritis (paralysis) when this vitamin is withheld from the diet. Addition of foods rich in vitamin B_1 to the diet of fowls so affected causes recovery (if the disease is not too far advanced). Beri beri can be cured in similar manner.

Vitamin B_1 occurs in vegetables, bran and germ cells of cereals, and in most other natural foods. Yeast is a rich source of this vitamin. Garden greens, spinach, raw cabbage, and canned tomatoes contain a considerable amount of it. Vitamin B_1 is somewhat more susceptible to the destructive action of heat under pressure than vitamin A, and considerable destruction of B_1 occurs during sterilization in a pressure cooker. Drying apparently lowers the activity of vitamin B_1 in vegetables only slightly. Not so much attention has been given to the study of this vitamin in fruits as in vegetables, but in the experiments thus far reported canning of fruits does not materially lower their content of this vitamin. Fresh fruits are generally lower than vegetables in vitamin B_1 and a considerable portion of it is destroyed during sterilization under pressure.

Vitamin C.—Scurvy is caused by lack in the diet of vitamin C. It has long been known that the use of limes, lemons, oranges, and fresh or canned vegetables would prevent and cure scurvy. Oranges and lemons are superior to limes in vitamin-C content. British sailing vessels carried lime juice as a preventive long before it was known that there was such a thing as vitamin C. The name "lime juicer" still sticks to British sailing vessels. Scurvy was the scourge of early polar expeditions.

This vitamin occurs in abundance in citrus fruits, some vegetables

such as fresh spinach and raw cabbage, and to some extent in root vegetables such as potatoes and carrots, both fresh and canned. Orange juice is widely used, particularly as a part of the diet of infants, because of its high content of vitamin C.

Vitamin C is sensitive to the combined action of heat and oxidation, that is, action of the air, and under certain conditions much or most of the vitamin is lost in canning. However, the vitamin C of tomatoes, of citrus juices, and of most other acid fruits is well retained in spite of the usual processes of sterilization and pasteurization.

Since the vitamin is so sensitive to oxidation, ordinary drying processes destroy most of the vitamin C of unsulfured fruits. Sulfuring fruits before drying prevents loss of vitamin C. Where possible, it is, therefore, desirable to use the fresh fruits, oranges being one of the best known sources of this vitamin. Canned tomatoes may also be used where fresh fruit is not obtainable. As vitamin C is not stored in the body some of it should be eaten every day.

Vitamin D.—Lack of vitamin D causes rickets, a well-known disease of the bones of improperly nourished children. The bones become soft and bend easily. Rickets is characterized by lack of development of bone tissue. Calcium and phosphorous are not properly assimilated in building bone when D is lacking.

Cod-liver oil is extremely rich in this vitamin and is, along with sunlight, the classic remedy and preventive for rickets. Milk and milk fat contain considerable vitamin D and egg yolk is also a very good source of this vitamin. Its presence in leafy vegetables has also been demonstrated.

Vitamin D is very resistant to the action of heat, oxidation, and chemicals. Cooking of foods in which it is found apparently does not noticeably lower its potency.

That sunlight can take the place of this vitamin in preventing and in curing rickets has been well proved. A common practice now is to expose infants to sunshine as a regular part of their care. Irradiation of the skin with ultraviolet light is also effective. The vitamin-D content of milk and of vegetable oils can be greatly increased by exposure to ultraviolet light, recent investigations show.

Vitamin E.—Vitamin E is rather widely distributed in foods, but is particularly abundant in leafy vegetables and in the germs of cereals. So far as is known it is not lacking in the average human diet. In experimentally fed rats sterility may be induced by withholding it from the diet, that is, the animals lose their power of reproduction.

It is very resistant to heat, oxidation, and chemical reagents. Canning and drying probably do not affect its activity.

Nicotinic Acid.—This vitamin prevents and cures pellagra, a disease prevalent in the southern states Milk, greens such as spinach, some fruits, and probably fresh meats, are believed to be good sources of this vitamin. It has been discovered only recently and its occurrence in various foods has not been thoroughly determined. It is very resistant to heat and oxidation. If present in the fresh food it is fully retained in the canned. It is classed as a part of the vitamin-B complex.

Summary of Vitamins.—Vitamins are essential food factors required for normal development and nutrition. With the exception of vitamin B_1 and vitamin C, and this only in part, canning does not appreciably affect their potency. Canned fruits, tomatoes, and most canned vegetables are rich sources of the various vitamins. Certain canned foods are richer than others in certain vitamins; therefore, in order to supply all of the vitamins, as well as to provide a balanced diet in other respects, it is wise to include in the family diet a variety of fruits and vegetables, canned, dried, and fresh.

FOOD POISONING

(Prepared by Dr. K. F. Meyer, Director of the G. W. Hooper Foundation, University of California, and by Dr. J. C. Geiger, Director of the Department of Health, City of San Francisco, California.)

Food poisoning, as it is understood today, is the result, directly or indirectly, of the contamination of food with certain bacterial organisms, and clinically it may be classified as an intoxication. Intoxication in this instance refers to poisoning by bacterial toxin; not to alcoholic intoxication. However, in the consumption of food contaminated with the paratyphoid group of bacteria, infections may occur.

With the growth of scientific knowledge regarding the specific dangers of contaminated food, there has been a more intelligent appreciation on the part of consumers and of health officials of the comprehensive measures that have usually been adopted for control in the distribution, handling, and processing of food whether it is canned or not. Food poisoning is probably as old a condition as any of those diseases affecting the human being and consequently has been known by a much varied terminology. Ptomaine poisoning, ice-cream poisoning, tinned-food poisoning, sausage poisoning, cheese poisoning, and meat poisoning, or any other particular kind of food poisoning suspected, have been given as the cause of different outbreaks, usually, without epidemiologic, bacteriologic, or toxicologic investigation. The foods that can be directly classified and identified with poisonings of nonbacterial nature are mushrooms, mussels, and certain others.

This descriptive terminology undoubtedly has led to a complexity of diagnosis, which has been further complicated by the recognition that certain preserved foods can contain a most virulent and thermolabile toxin, causing as a result when ingested, the so-called botulinus intoxication. Experience has taught that in the United States, outbreaks of food poisoning due to bacteria other than botulinus are fairly common. A careful laboratory examination of material from typical outbreaks has shown that the new type of food poisoning due to the toxic products of the staphylococcus is much more frequently encountered than has formerly been believed. Poisoning cases of food infections due to the paratyphoid or salmonella bacilli are relatively rare.

The recognition of these types of food poisoning, clinically, should present very little difficulty, whether the condition is due to food contaminated with the staphylococcus group, with the paratyphoid group, or with the toxin of *Bacillus botulinus*, since each causes totally dissimilar symptoms. The laboratory procedure incident to the isolation of the staphylococcus or the paratyphoid group from the toxin of *B. botulinus* in foods is technically well known. The method for determination of the presence of *B. botulinus* toxins is also well known to laboratory technicians. Therefore, the investigative problem is comparatively simple. However, in the majority of the outbreaks recorded, the well-known facts mentioned above are overlooked either because of the limited duration of the illness or because of incomplete epidemiologic, bacteriologic, or toxicologic investigation.

It is deemed important to point out briefly in the accompanying table the different investigative procedures that are suggested in outbreaks, and the clinical symptoms in both types of food poisoning.

Never taste spoiled canned food. Suspicious jars or cans of food, that is, those which possess a disagreeable odor or show gas pressure, should be destroyed without tasting. The contents of such jars should be mixed with several spoonfuls of lye, and jar and contents buried. Suspected material should be destroyed and not fed to chickens or animals. Many cases are on record in which large numbers of chickens have been killed by eating spoiled canned foods. Human cases of fatal poisoning have resulted from merely tasting spoiled cans of food. *Report at once* all such types of illness to your family physician[10] and to the local health officer. The following table is largely for his guidance; call his attention to it at once in cases of suspected food poisoning.[11]

[10] It is also suggested that he immediately notify the Hooper Foundation for Medical Research, Second and Parnassus Avenues, San Francisco, California.

[11] As first-aid treatment give an emetic and an enema or purgative to eliminate from the system as much of the unabsorbed toxin as possible.

TABLE 4

COMPARATIVE PROCEDURES IN CASES OF FOOD POISONING

(For guidance of physicians or health officers)

GENERAL FOOD POISONING	BOTULISM
INCUBATION PERIOD	
Usually 2 to 4 hours, staphylococcus toxin. If over 12 hours, salmonella bacilli.	Usually 24 to 38 hours.
TREATMENT	
Supportive and eliminative.	Botulinus antitoxin, specific type; give both A and B antitoxin; absolute quiet; eliminative.
INVESTIGATION PROCEDURE	
1. Use incubation period for basis of determining the causative meal. 2. Always suspect freshly cooked or warmed-over foods, cakes, pastry, minced meats, etc. Preserved foods are rarely at fault. The foods are usually all right as to taste, appearance, odor, and texture. 3. Bacteriologic examination of excreta of patients and the suspected food for the salmonella group, staphylococcus group, and other organisms. 4. Bacteriologic and epidemiologic search for human carriers and possible contamination from animal sources. 5. Complications: appendicitis, cholecystitis, persistant elevation of temperature (paratyphoid infection).	1. Use incubation period for basis of determining the causative meal. 2. Always suspect preserved foods; likewise, meat products such as sausages. Spoilage of food is noted in many instances. 3. Test suspected food for toxin by animal inoculation; mice, guinea-pigs, or rabbits. Test for type with specific antitoxin. Cultures of suspected food for the presence of spores, particularly if food has been previously boiled. 4. Search for domestic animals, such as chickens with symptoms of limberneck for corroborative field and laboratory evidence. 5. Complications: bronchopneumonia. 6. Human outbreaks are usually due to type-A toxin, occasionally to type B.
SYMPTOMATOLOGY	
Sudden onset; nausea, vomiting, abdominal pain, prostration, diarrhea, and rise of temperature. Mortality, 0 to 1 per cent. Case infectivity rate high.	Delayed onset; marked muscular weakness; gastro-intestinal symptoms, rare; disturbances of vision with diplopia and blepharoptosis; loss of ability to swallow and talk; constipation; rapid pulse and subnormal temperature; rarely any pain; death from respiratory failure. Mortality over 60 per cent. Case infectivity rate usually 100 per cent.

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